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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/828,437	04/21/2004	Shosuke Endoh	252112US2	5495

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EXAMINER	
DHINGRA, RAKESH KUMAR	

ART UNIT	PAPER NUMBER
1792	

NOTIFICATION DATE	DELIVERY MODE
10/16/2008	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/828,437	ENDOH ET AL.	
	Examiner	Art Unit	
	RAKESH K. DHINGRA	1792	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE _03_ MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on _01 July 2008_.

2a)☒ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) _4-8,11,13-15 and 18-31_ is/are pending in the application.

4a) Of the above claim(s) _4-7,11 and 22-27_ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) _8,13-15,18-21,28-31_ is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on _15 November 2006_ is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 8 and 12-21 have been considered but are moot in view of the new ground(s) of rejection as explained hereunder.

Applicant has amended claim 8 by adding new limitations e.g. "the chuck voltage and the pressure of the heat transfer gas are not set to zero so as to carry out cooling of said focus ring during conveying the object to be processed into and out from said chamber. Further, applicant has added new claims 28-31.

Accordingly claims 4-8, 11, 13-15 and 18-31 are pending out of which claims 8, 13-15 and 18-21, 28-31 are presently active.

New reference US PGPUB 2002/0037652 – Moriya et al) when combined with Koshiishi et al Kanno et al and Howald et al read on amended claim 8 limitations. Accordingly claims 8, 13-15 and 18-20, 28, 29 have been rejected under 35 USC 103 (a) as explained below. Further, remaining claims 21, 30, 31 have also been rejected under 35 USC 103 (a) as explained below. Applicant's argument regarding claim 21 that Huang does not teach newly added limitation of claim is moot in view of new grounds of rejection of claim 8 that includes this limitation.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be

patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 8, 13-15, 18-20 are rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US 6,125,025) and Moriya et al (US 2002/0037652).

Regarding Claim 8: Koshiishi et al teach a plasma processing apparatus (Figures 1, 4) comprising:

a susceptor 11 having an electrostatic chuck (through dielectric films 14a, 14b) on which is mounted a wafer W that is subjected to plasma processing and a focus ring 12 having a contact surface is disposed in contact with said electrostatic chuck around a periphery of wafer W, the focus ring 12 is mounted on the electrostatic chuck having a chucking device 11a, 11b to which a DC voltage 15 is applied and the focus ring is attracted by electrostatic attraction to the electrostatic chuck by the chucking voltage applied to the chucking device 11a, 11b;

a heat exchange means provided at the said contact surface for carrying out heat exchange with the focus ring 12, the heat exchange means comprising an opening (in the dielectric layer 14b for the heat transfer gas coming through passage 17) and filled with heat transfer medium, and further comprising a supply path (connecting portion of supply path 17 to the focus ring 12) that supplies a heat transfer gas to said contact surface [e.g. Figs. 1, 4 and para. 0038, 0043).

Koshiishi et al further teach that for attracting the wafer and the focus ring, different voltages are applied from power supply 15 through switch 24 that is controlled by a switch controller 25 (a controller) as per sequence of processing of wafer (that is supply of voltage to chucking electrode 11a, for chucking the substrate is controlled by a controller) [paragraphs 0055-0059].

Koshiishi et al do not explicitly teach the heat exchange means comprising a groove in the electrostatic chuck, and also do not teach that the controller sets the chuck voltage applied to the chuck device high during at least one processing sequence, and said controller controls the chucking voltage with each of multiple sequence of plasma process, and the controller also controls a pressure of the heat transfer gas supplied from said heat exchange means and changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process.

Koshiishi et al teach the heat exchange means comprises an opening in the contact surface, but not teach a groove. However provision of grooves as a part of heat exchange means in electrostatic chucks is known in the art as per reference cited hereunder.

Kanno et al teach a plasma apparatus comprising an electrostatic chuck 10 for supporting a wafer and where the electrostatic chuck has plurality of concentric grooves provided on its top surface, so that the attracting areas on the positive and negative electrode sides change depending on the size and shape of the dispersion groove or recess, and that a residual attracting force is generated

(e.g. Fig. 1, 2 and col. 2, lines 45-65 and col. 8, line 15 to col. 9, line 40). Though Kanno et al do not explicitly teach such groove formed on the contact surface between the focus ring and the electrostatic chuck, it would be obvious to provide similar groove in the apparatus of Koshiishi et al to increase the attraction force of focus ting to the electrostatic chuck, as per teaching of Kanno et al.

Therefore it would have been obvious to one of ordinary skills in the art at the time of the invention to provide the electrostatic chuck with groove at the contact surface as taught by Kanno et al in the apparatus of Koshiishi et al to obtain increased attraction force between the focus ring and the electrostatic chuck.

Koshiishi et al in view of Kanno et al do not teach the controller sets the chuck voltage applied to the chuck device high during at least one processing sequence, and said controller controls the chucking voltage with each of multiple sequence of plasma process, and the controller also controls a pressure of the heat transfer gas supplied from said heat exchange means and changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process.

Howald et al teach a plasma processing apparatus comprising an electrostatic chuck 30 mounted in chamber 10 and connected to a programmed DC power source 38 for processing a substrate 32. Howald et al further teach that during initial processing of workpiece 32, voltage at terminal 40 is 5000 volts (high) and subsequently during processing the voltage reduces with respect to point 42. Howald et al also teach that supply of voltage from DC power source 38 is controlled by a computer system 64 (controller) using a stored program which causes the microprocessor 66 to control DC voltage source 38 to supply a sequence of time spaced step voltages during processing of substrate (that is as per multiple sequence of process steps). Howald et al additionally teach that DC

power source voltage is also varied in response to flow sensor 70 to maintain constant chucking force (e.g. Fig. 1 and col. 9, line 5 to col. 17, line 10). Additionally Howald et al also teach a pressure sensor (not shown in Figures) that is responsive to the gas pressure exerted by the helium gas on the back face of substrate 32 and which (the pressure sensor), in combination with microprocessor 66 and flow sensor 70 enables controls the pressure of the helium gas supplied to valve 35 and line 34. It would be obvious to use a controller as taught by Howald et al, that controls the chucking voltage during multiple sequence of process steps, in the apparatus of Koshiishi et al in view of Kanno et al to obtain control of chucking voltage and the temperature of the substrate during processing.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a controller that sets the chuck voltage applied to the chuck device high during substrate processing sequences as taught by Howald et al in the apparatus of Koshiishi et al in view of Kanno et al to obtain desired clamping force and temperature control of the substrate during processing steps.

Koshiishi et al in view of Kanno et al and Howald et al do not explicitly teach the controller changes the pressure of the heat transfer gas supplied in accordance with each of multiple steps of the plasma process and controller controls the chuck voltage and the pressure of the heat transfer gas are not set to zero so as to carry out cooling of said focus ring during conveying the object to be processed into and out from said chamber.

Moriya et al teach a plasma apparatus comprising a processing chamber 7 having a lower electrode 3 with an electrostatic chucking by means of power supply 12 to fix a substrate 1 to a stage 5. Moriya et al also teach that helium gas that is flowed under the ESC for cooling purposes. Moriya et al additionally teach a computer 21 with a signal processor 23 that controls the conveyance in/out

of wafer, the flow (related to pressure) of helium gas for cooling, and supply of chucking voltage to the electrostatic chuck (e.g. Fig. 3, 15 and para. 0056, 0072-0078). It would be obvious to program the controller and processor for controlling the supply of chucking voltage and pressure of helium gas during all processing steps including during conveyance in/out of substrate. Specific values of voltage and pressure would be dependent upon process limitations like processing temperature, desired temperature of wafer, focus ring, and gas pressure etc.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to use a controller that controls the pressure of the heat exchange gas and supply of chucking voltage to electrostatic chuck during all processing steps including during conveyance in/out of substrate as taught by Moriya et al in the apparatus of Koshiishi et al in view of Kanno et al and Howald et al to obtain uniform processing of substrate over the entire diameter.

Regarding Claim 13: Kanno et al teach the depth of groove is 0.3 mm (meets the claim limitation of not less than 0.1 mm) [col. 9, lines 30-41].

Regarding Claim 14: Kanno et al teach the gas groove is formed in such a shape that a heat transfer gas for promoting cooling of a wafer during processing effectively flows over the entire back surface of the wafer and the groove pattern is capable of giving a desired temperature distribution to the wafer during processing (col. 18, lines 18 -45).

Regarding Claim 15: Kanno et al teach the grooves comprise annular shape concentric with cover 22 (focus ring) [Fig. 2].

Regarding Claim 18: Koshiishi et al teach an electrode 11b built into the chuck device that faces the focus ring 12 (Figure 4).

Regarding Claims 19, 20: Claim limitations reciting heat exchange means reducing temperature of focus ring to at least 20 degrees C below a temperature of the electrostatic chuck, and to a temperature not more than 0 degrees C are functional limitations, and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitations.

In this connection courts have ruled:

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.,* 15USPQ2d 1525, 1528 (Fed. Cir. 1990).

Regarding claim 28: Claim limitation "the supply path is evacuated when reducing a pressure inside said chamber" is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limiattion.

In this regard courts have ruled:

Claims directed to apparatus must be distinguished from the prior art in terms of structure rather than function. *In re Danly*, 263 F.2d 844, 847, 120 USPQ 528, 531 (CCPA 1959). Apparatus claims cover what a device is, not what a device does *Hewlett-Packard Co. V. Bausch & Lomb Inc.,* 15USPQ2d 1525, 1528 (Fed. Cir. 1990).

Regarding Claim 29: Claim limitation "Claim 29 (New): A plasma processing apparatus as claimed in claim 8, wherein the pressure of the heat transfer gas is increased in accordance with incrementing of the chuck voltage during the process sequence" is a functional limitation and since the apparatus of prior art meets the structural limitations of the claim, the same is considered capable of meeting the functional limitation (Relevant case law already cited under claim 28).

Claim 21 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US 6,125,025) and Moriya et al (US 2002/0037652) as applied to Claims 8, 13-15, 18-20, 28, 29 and further in view of Huang (US PGPUB no. 2004/0005726).

Regarding Claim 21: Koshiishi et al in view of Kanno et al, Howald et al and Moriya et al teach all limitations of the claim except that heat exchange medium comprises heating means for heating the focus ring.

Huang teach an apparatus that includes an electrostatic chuck 16 with a temperature controlled focus ring 52 having heat transfer means 54. Huang further teach that the apparatus comprises heat transfer means that can heat the focus ring (e.g. Fig. 3 and para. 0041).

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide heating mean for heating the focus ring using as taught by Huang in the apparatus of Koshiishi et al in view of Kanno et al, Howald et al and Moriya et al to enable control the temperature of the focus ring and control plasma density at the edge of the substrate s per process limitations like amount of radicals to be adsorbed by the focus ring (para. 0042).

Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US 6,125,025) and Moriya et al (US 2002/0037652) as applied to Claims 8, 13-15, 18-20, 28, 29 and further in view of Hasegawa et al (US 5,556,500).

Regarding Claim 30: Koshiishi et al in view of Kanno et al, Howald et al and Moriya et al teach all limitations of the claim except a heating member in contact with said focus ring and covering at least an outer peripheral surface of said focus ring.

Oyabu teaches a plasma apparatus with a processing chamber 12 that includes a focus ring 114 and a heating member 116a in contact with outer peripheral surface of the focus ring 114. Oyabu also teaches a cylindrical body 124 that surrounds the focus ring 114 and also control the heating of focus ring 114 (e.g. Fig. 1 and col. 5, lines 30-42). Oyabu does not explicitly teach that heating member 116a covers the outer peripheral surface of focus ring, but teaches that shape of the same is optimized to reduce the deposition of reaction products on the individual parts like focus ring etc.

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to provide a heating member in contact with focus ring and whose shape is optimized as taught by Oyabu in the apparatus of Koshiishi et al in view of Kanno et al, Howald et al and Moriya et al to enable control the temperature of the focus ring and minimize the deposition of reaction products on the focus ring.

In this regard courts have ruled:

It is well settled that determination of optimum values of cause effective variables such as these process parameters is within the skill of one practicing in the art. *In re Boesch*, 205 USPQ 215 (CCPA 1980).

Claim 31 is rejected under 35 U.S.C. 103(a) as being unpatentable over Koshiishi et al (US PGPUB No. 2003/0106647) in view of Kanno et al (US 6,373,681), Howald et al (US 6,125,025) and Moriya et al (US 2002/0037652) as applied to Claims 8, 13-15, 18-20, 28, 29 and further in view of Birang et al (US 5,491,603).

Regarding Claim 31: Koshiishi et al in view of Kanno et al, Howald et al and Moriya et al teach all limitations of the claim except the controller is configured to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber.

Birang et al teach a plasma apparatus comprising a heat exchange gas system for an electrostatic chuck that includes a pressure transducer 240, a flow controller 230 and a controller 250. Birang et al further teach that the controller 250 enables control of chucking/dechucking voltage applied to electrostatic chuck. Birang et al also teach that a positive voltage of 2000V is applied to electrostatic chuck during wafer's conveyance and further during processing also a positive voltage is applied for chucking (since the wafer bias adds to the chucking voltage) [e.g. Fig. 2 and col. 3, lines 35-65].

Therefore it would have been obvious to one of ordinary skill in the art at the time of the invention to configure the controller to control the chuck voltage to maintain a same polarity during the at least one processing sequence as during conveying the object from the chamber as taught by Birang et al in the apparatus of Koshiishi et al in view of Kanno et al, Howald et and Moriya et al to obtain effective chucking of wafer to the substrate during processing.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

Sango (US 6,391,789) teaches that magnitude of chucking voltage applied to electrostatic chuck is determined based on the place occupied by the single semiconductor wafer in the

semiconductor wafer lot (would include conveyance in/out position of wafer) and a lapse of time from the previous dry etching (para. 20).

Any inquiry concerning this communication or earlier communications from the examiner should be directed to RAKESH K. DHINGRA whose telephone number is (571)272-5959. The examiner can normally be reached on 8:30 -6:00 (Monday - Friday).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Parviz Hassanzadeh can be reached on (571)-272-1435. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Rakesh K Dhingra/
Examiner, Art Unit 1792

/K. M./
Primary Examiner, Art Unit 1792